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“Mosaic Tile Model to Compute Gravitational Field for Infinitely Thin
Non Axisymmetric Objects and its Application to Preliminary Analysis
of Gravitational Field of M74”

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Using the analytical expressions of the Newtonian gravitational potential and the associated acceleration vector for an infinitely thin uniform rectangular plate, we developed a method to compute the gravitational field of a general infinitely thin object without assuming its axial symmetry when its surface mass density is known at evenly spaced rectangular grid points. We utilized the method in evaluating the gravitational field of the HI gas, dust, red stars, and blue stars components of M74 from its THINGS, 2MASS, PDSS1, and GALEX data. The non axisymmetric feature of M74 including an asymmetric spiral structure is seen from (i) the contour maps of the determined gravitational potential, (ii) the vector maps of the associated acceleration vector, and (iii) the cross section views of the gravitational field and the surface mass density along different directions. An x-mark pattern in the gravitational field is detected at the core of M74 from the analysis of its dust and red stars components. Meanwhile, along the east-west direction in the central region of the angular size of $1'$, the rotation curve derived from the radial component of the acceleration vector caused by the red stars component matches well with that observed by the VENGA project. Thus the method will be useful in studying the dynamics of particles and fluids near and inside spiral galaxies with known photometry data. Electronically available are the table of the determined gravitational fields of M74 on its galactic plane as well as the Fortran 90 programs to produce them.